

Teacher Note

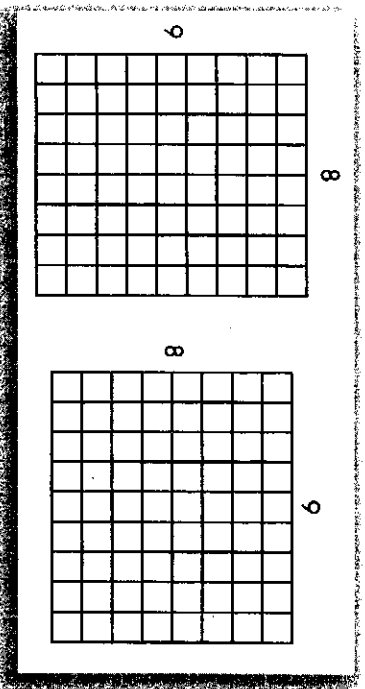
Representing Multiplication with Arrays

Representing mathematical relationships is a key element of developing mathematical understanding. For multiplication, the rectangular array is an important tool. It meets all of the criteria for a powerful mathematical representation: it highlights important relationships, provides a tool for solving problems, and can be extended as students apply ideas about multiplication in new areas.

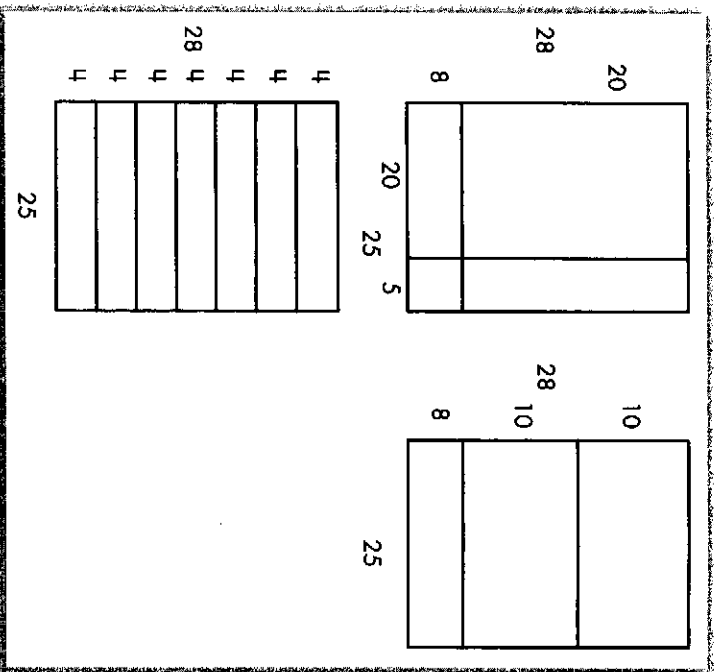
Why Arrays for Multiplication?

As students come to understand the operation of multiplication in Grades 3 and 4, they gradually move away from thinking of multiplication only as repeated addition. They learn that multiplication has particular properties that distinguish it from addition. A number line or hundred chart can be used to show how multiplication can be viewed as adding equal groups. However, neither of these tools provide easy access to other important properties of multiplication. The rectangular array provides a window into properties that are central to students' work in learning the multiplication combinations and in solving multidigit multiplication and division problems.

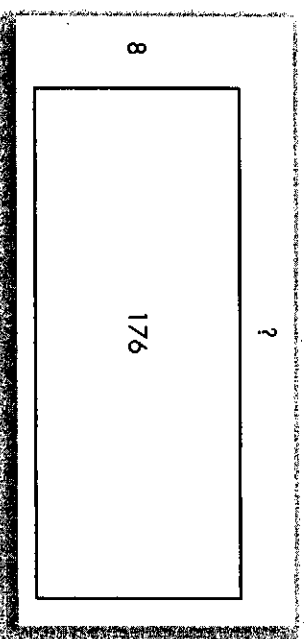
For example, the rectangular array makes it clearer why the product of 9×8 is equal to the product of 8×9 . The array can be rotated to show that 9 rows with 8 in each row has the same number of squares as 8 rows with 9 in each row. The column in one becomes the row in the other and vice versa.



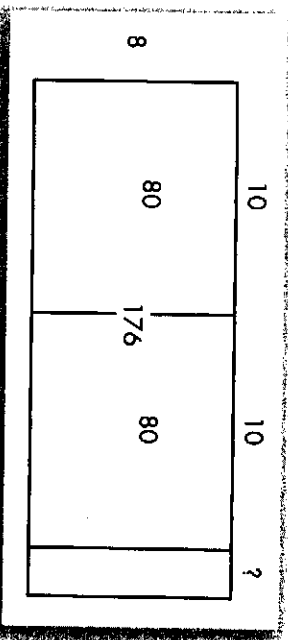
Arrays are particularly useful for solving or visualizing how to solve multidigit multiplication problems. After students have worked with rectangular arrays for single-digit multiplication combinations and thoroughly understand how an array represents the factors and product, they can use arrays to solve harder problems. The array for 28×25 can be broken up in many ways.



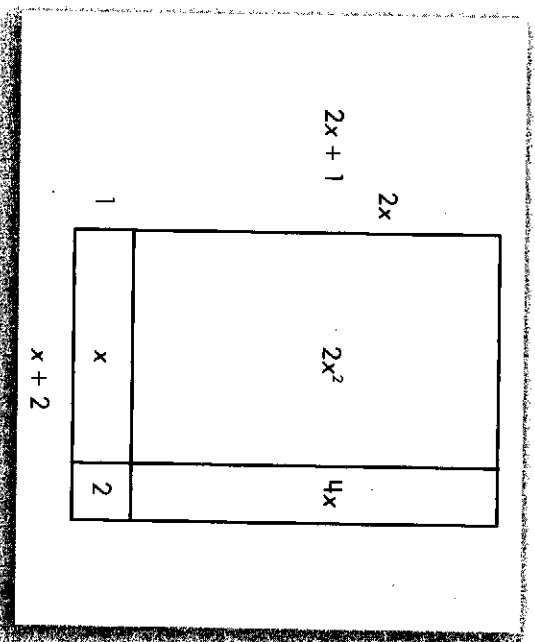
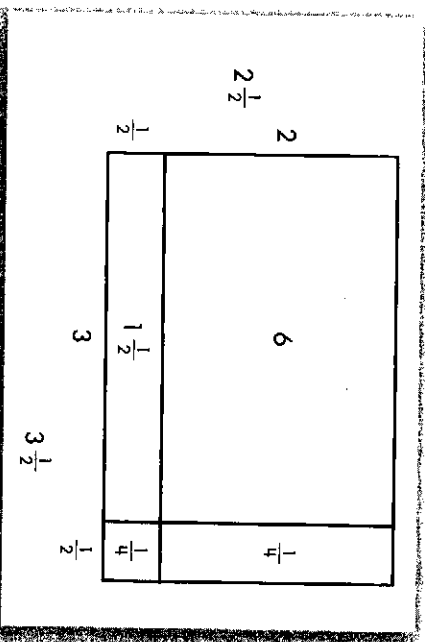
Arrays also support students' learning about the relationship between multiplication and division. In division, we know the total amount (the area of the array) and one factor (1 side of the array) and are trying to find the other factor.



Students can think of “slicing off” pieces of the rectangle as they gradually figure out the other factor.



Finally, the use of the rectangular array can be extended in later grades as students work with multiplication of fractions and, later, of algebraic expressions.



Labeling Arrays

For multiplication notation to describe arrays, the *Investigations* curriculum uses the convention of designating the number of rows first and the number in each row second; (e.g., 3×2 indicates 3 rows with 2 in each row). This convention is consistent with using 3×2 to indicate 3 groups of 2 in other multiplication situations (e.g., 3 pots with 2 flowers in each pot). However, at this age level, it is not necessary for students to follow this system rigidly; trying to remember which number stands for rows and which for the number in a row can be unnecessarily distracting for students. When students suggest a multiplication expression for an array, what is important is that they understand what the numbers mean. For example, a student might show how 3×2 represents 3 rows of cans with 2 in each row or 3 cans in each of 2 rows. Note that in other cultures, conventions about interpreting multiplication expressions differ. In some countries, the convention for interpreting 3×2 is not “3 groups of 2” but “3 taken 2 times.”